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MONTHLY LETTER OF THE BUREAU OF ENTOMOLOGY

UNITED STATES DEPARTMENT OF AGRICULTURE

Number 240

(Not for publication)

May 1934

NEW DIVISIONS ESTABLISHED

Statements outlining the activities of certain new divisions have recently been generally distributed. These divisions are the Division of Control Investigations, the Division of Insect Pest Survey and Information, both established as of May 1, and the Division of Foreign Parasite Introduction, established as of May 15. Changes effective May 1 in the method and procedure of handling manuscripts were also announced and the activities of the editorial unit were modified by transfer of certain functions to the new Division of Insect Pest Survey and Information. The proposed method of handling manuscripts should expedite their review, editorial consideration, and approval. Among other changes the revised plan provides that if a manuscript is returned to a division for consideration of comments by reviewers the name of the reviewer will accompany the comments.

Including, as it does, items for the month of April, this issue of the Monthly Letter is arranged in accordance with the plan for preceding numbers. Although the new divisions are organized and operating, changes as to general subject matter and arrangement of the Monthly Letter will await other modifications that may be found desirable in the presentation of news items when the organization authorized becomes fully effective on July 1.

PROPER DESIGNATION FOR LABORATORIES

The preferred and correct designation for field laboratories is "Laboratory, Bureau of Entomology, U. S. Department of Agriculture." Other designations, such as "U. S. Entomological Laboratory", are incorrect and should not be used. Where signs or similar labels give erroneous designations, changes should be made at the earliest practicable date.

FRUIT INSECTS

Elimination of peach borer infestation in peach nursery stock.-- Oliver J. Snapp and J. R. Thomsen, Jr., of the Fort Valley, Ga., laboratory, have made a final report on a series of experiments conducted during the past winter for the purpose of developing methods of eliminating infestation by Aegeria exitosa Say in nursery stock. This work was under-

taken at the request of the Bureau of Plant Quarantine, which is interested in the problem because of the possible part played by the peach borer in the dissemination of the phony peach disease and which furnished infested nursery stock for the work. The experiments resulted in the conclusion that all peach borers may be eliminated from nursery stock without injury to the trees by dipping the stock in hot water at 108.5° F. (42.5° C.) for a period of 1 hour. The margin of safety is rather narrow, however, since treatment at 113° F. for $1\frac{1}{2}$ hours resulted in serious injury. In other experiments it was also found that the borers could be eliminated from dug nursery stock without tree injury by spraying the soil over heeled trees with an emulsion containing 15 percent of ethylene dichloride. The direct application of ethylene dichloride emulsion to the tree roots at strengths sufficient to kill all the borers, however, resulted in more or less injury.

Studies of differences between two species of peach borers.--In making studies of the peach borers, Messrs. Snapp and Thomson have encountered a problem of distinguishing the larvae of the peach borer (Aegeria exitiosa Say) from those of the lesser peach borer (Aegeria pictipes G. & R.). The two species are sometimes found feeding in the same part of the tree, although for the most part the peach borer feeds near or below the ground line and the lesser borer feeds in injured areas in the higher parts of the tree. In order to obtain authentic larval material, borers are being bred from reared adults that may be distinguished without difficulty.

Developmental period of Mexican fruit fly varies in different fruits.--W. E. Stone, of the Mexico City, Mex., laboratory, has found that the developmental period of Anastrepha ludens Loew varies with different host fruits. The following records were made at a temperature of 77° F. (25° C.):

Fruit	: Lots	: Number	: Period to first puparia	: Days	: Period to first adults	: Days
Mango-----:	9	:		15.6	:	33.2
Orange -----:	35	:		27.2	:	46.3
Grapefruit----:	16	:		25.9	:	44.3
Apple-----:	30	:		30.4	:	52.8

Although the data are not sufficiently complete to justify conclusions, a possible correlation between the developmental period and resistance to vapor-heat sterilization is suggested. In mangoes, in which the developmental period is short, the larvae are less readily killed by the vapor-heat treatment than in oranges, in which the developmental period is longer. Data are not available on sterilization of apples.

Mexican "cockroach plant" contains principle poisonous to fruit flies.--C. C. Plummer, Mexico City, has made a study of the interesting

"cockroach plant" (Haplophyton cimicidum DC.), commonly known in Mexico as "la hierba de la cucaracha." This plant has been used since time immemorial as an insecticide for killing cockroaches, flies, mosquitoes, fleas, body lice, and other insects. In the year 1900 the plant was so abundant near Yantepec, Morelos, that it could be obtained for only the cost of cutting it. Decoctions prepared from this plant appear to act chiefly as a stomach poison, and have been found very toxic to two species of fruit flies (Anastrepha ludens and A. striata Shin.). The material produces a paralysis, from which the flies rarely recover, although they may live for several days. The data obtained indicate that the material will not decompose and lose much of its toxicity when held for prolonged periods at a high temperature and a low humidity as a dried spray on glass plates. When held in solution at room temperature for approximately a year and a half, however, its toxic properties were lost. The chemistry of this plant is only partially known. The Bureau of Chemistry and Soils has isolated and identified mannitol as one of its constituents.

Thiodiphenylamine shows promise as a stomach poison.--E. H. Siegler and Francis Munger, of the Takoma Park, Md., laboratory, have found thiodiphenylamine (phenothiazine) very toxic to larvae of the codling moth (Carpocapsa pomonella L.) in recent laboratory experiments. This material was brought to this Bureau's attention by the Bureau of Chemistry and Soils. The material is not readily wettable with water, but this difficulty has been overcome by mixing it with fuller's earth. Preliminary small-scale tests on foliage have not given any injury. The chemical is not available commercially, but it may be prepared by fusing sulphur (in the presence of a catalyst) with diphenylamine, a substance readily obtainable.

Lime-sulphur with wettable sulphur effective against whitefly eggs.--W. W. Yothers and R. L. Miller, of the subtropical fruit insect laboratory at Orlando, Fla., have found that lime-sulphur solution is effective in controlling the citrus whitefly (Dialeurodes citri Ashm.) in the egg stage. It has been known for some time that the presence of sulphur on citrus trees prevents the settling of larvae of this insect. Applications of lime-sulphur solution combined with wettable sulphur applied during April, when the whitefly eggs were in the later stages of embryonic development, gave nearly 100 percent kill of the eggs. This has the effect of extending the period during which whitefly sprays may be applied from a week or 10 days to 2 or even 3 weeks.

JAPANESE AND ASIATIC BEETLES

Depth of occurrence of Jap beetle population in soil.--The distribution of the general soil population of Popillia japonica Newm. with reference to depth of occurrence in the ground, as summarized from the empiric summary of the seasonal surveys conducted by H. Fox, Moorestown, N. J., for April is shown in the following table:

Period	Soil population according to depth in inches					
	0 to 1	1 to 2	2 to 4	4 to 6	6 to 8	8 to 10
Percent	Percent	Percent	Percent	Percent	Percent	Percent
April 1-10---	10.9	23.8	57.3	7.9	0	0
11-20---	34.2	33.6	29.7	2.6	0	0
21-30---	64.8	28.7	6.5	0	0	0
Month-----	36.6	28.7	31.2	3.5	0	0

It is evident from the results given above that the periodic upward movement of the larvae was in progress throughout practically the entire month of April. As usual, this movement was coincident with the rise of soil temperature above 50° F. at the depths occupied by the larvae.

Seasonal fluctuations.--Data on changes in population frequencies during the current annual cycle of the Japanese beetle were derived in April from the records of both seasonal and periodic series of surveys conducted by Mr. Fox in 1933-34.

The general results along this line as summarized from the records of the seasonal series of surveys are tabulated as follows:

Period	Average larvae per square foot			
	New Jersey		Pennsylvania	
	stations	Number	stations	General
Oct. 1-15-----	6.9	Number	10.6	8.8
16-31-----	6.8		9.1	8.0
Nov. 1-15-----	6.9		8.6	7.8
16-30-----	6.4		8.1	7.3
Dec. 1-15-----	6.7		7.8	7.3
Mar. 16-31-----	5.1		6.6	5.9
Apr. 1-15-----	5.5		8.1	6.8
16-30-----	6.0		8.5	7.3

The results on seasonal fluctuations as summarized from the records of the periodic series of surveys are given below:

Stations (Golf courses at)	Date	Average larvae per square foot
		Number
Moorestown, N.J.-----	: Oct. 3	: 3.1
	: Apr. 5-9	: 2.5
Merchantville, N.J.-----	: Sept. 26	: 2.9
	: Apr. 9	: 2.1
Riverton, N.J.-----	: Oct. 2-11	: 1.4
	: Apr. 10-11	: 1.2
Tavistock, N.J.-----	: Sept. 26-28	: 1.9
	: Apr. 12-13	: 1.8
Jenkintown, Pa.-----	: Sept. 19-20	: 13.3
	: Apr. 13-17	: 10.4
St. Martins, Pa.-----	: Sept. 25	: 14.7
	: Apr. 18	: 15.6
Torresdale, Pa.-----	: Oct. 30	: 5.4
	: Apr. 19	: 5.5
Burlington Co., N.J.-----	: Oct. 11	: 15.6
	: Apr. 23	: 16.3
Hopewell, N.J.-----	: Oct. 12	: 17.9
	: Apr. 24	: 14.8
Philmont, Pa.-----	: Oct. 26	: 12.1
	: Apr. 25	: 13.5
Springdale, N.J.-----	: Nov. 13	: 24.4
	: Apr. 26	: 25.3

Comparison of the results given in these two tables fail to indicate that the unusually cold weather of February 1934 reduced the population of Japanese beetles in the soil. Instead, a reduction of about 3 percent in the periodic surveys, apparently no greater than the normal reduction in a mild winter, characterized the unusual winter just past. This view is quite in line with the indications afforded by the evidence from both the seasonal and periodic series of surveys.

Stomach poisons for Jap beetle in soil.--Tests were continued by W. E. Fleming, F. E. Baker, and L. Koblitsky, Moorestown, with third-instar larvae under controlled conditions using various materials as stomach poisons. Samples of chemically pure and 90 percent rotenone, derris containing 4 percent rotenone, and pyrethrum were tested at rates ranging from 500 to 5,000 pounds per acre without any indication of these materials being toxic to the larvae. Basic lead arsenate at the rate of 10,000 pounds per acre and hydrated lime at the rate of 25,000 pounds per acre were not injurious to the larvae. Tests made with various samples of acid lead arsenate containing from 30.5 to 33.8 percent arsenic pentoxide showed that the difference in the arsenic content within this range did not significantly change the insecticidal action of the material on larvae in the soil.

Distribution and abundance of oriental beetle.-- The survey diggings of Anomala orientalis Waterh. by H. C. Hallock at Jericho, N.Y., show an average of 14 larvae per square foot, which is about the same number as were found in the spring of 1933. The range in abundance this spring has been from none to 77 grubs per square foot. The abundance in the older infested area in the southern part of Westchester County, N.Y., extending from New Rochelle and Mt. Vernon on the south to White Plains on the north, shows very little change from the conditions of last year. This season additional infestations in the vicinity of Ossining, where there is considerable destruction of lawns, were brought to our attention and lead arsenate has been used to protect the lawns.

Distribution and abundance of Asiatic garden beetle.--The survey diggings of Autoserica castanea Arrow by H. C. Hallock at Jericho, N.Y., show an average of 29 larvae per square foot with a range of 1 to 60, indicating that A. castanea is a little more numerous than in the spring of 1933. Although the survey work at Locust Valley, N.Y. (in sod at the edge of the subsistence garden), has not progressed far enough to give any definite data, it now appears that the Asiatic garden beetle is more numerous here than at Jericho. On Long Island there are indications that the insect is spreading. During April new infestations were discovered at Syosset in the very eastern part of Nassau County and on the grounds of the New York State School of Applied Agriculture, east of Farmingdale, in Suffolk County. The infestations in Westchester and Bronx Counties are about the same as last season, except that the infestation in the vicinity of Yonkers has become heavier. Lawns in the northern part of Yonkers are showing sufficient turf injury to necessitate rebuilding portions of the lawns on some of the estates.

Committee report of survey of Division of Japanese and Asiatic Beetles.--The committee appointed by the Chief of the Bureau to make a survey of the work of this Division consisted of W. C. O'Kane, New Hampshire, Chairman; W. E. Britton, Connecticut; T. J. Headlee and H. B. Weiss, New Jersey; P. J. Parrott, New York; and C. H. Richardson, Iowa. The committee met at Moorestown, N. J., on March 13 and spent practically the remainder of the week at the laboratory. The report commends accomplishments in general and the administration of the physical plant, and also makes a number of specific recommendations and suggestions on the proposed program of work. In line with these recommendations and suggestions certain changes are being made in the research program for the coming season.

TRUCK CROP AND GARDEN INSECTS

Early appearance of Mexican bean beetle in Virginia.--The first snap beans of the season in the Norfolk, Va., trucking area were up on April 18, 1934, according to a report by L. W. Brannon, of the Norfolk laboratory. This was only 3 days later than the first beans observed in 1933. Daily field examinations have been made in order to determine the first appearance

in the field of the Mexican bean beetle (Epilachna corrupta Muls.). Records of the first appearance of the Mexican bean beetle in the field in the Norfolk area for the years 1929 to 1934, inclusive, are as follows:

1929, May	6
1930, May	1
1931, May	6
1932, May	4
1933, April 27	
1934, April 26	

The bean beetle population has increased considerably in the Norfolk area in the past few seasons and it is probable that the beetle was found earlier in the field during the past two seasons because increase in abundance made it easier to find the first adult.

Early maturity of wild host plant will probably reduce lime bean pod borer in California.--Rodney Cecil, of the Ventura, Calif., laboratory, reports that Lupinus succulentus, the most important wild host of the lima bean pod borer (Etiella zinckenella Treit.) matured more rapidly than usual this season owing to high temperature and low humidity. The rapid maturity of this plant prevents the maturing of pod borer larvae and will probably reduce the number of adult pod borers that will eventually migrate to the bean fields. The cultivated host plants, consisting of various varieties of lima beans, were all planted in April. In the course of making extensive collections of L. succulentus, no mature pod borer larvae have been found.

Wisconsin pea crop imperiled by conditions favoring pea aphid.--J. E. Dudley, of the Madison, Wis., laboratory, reports that an exceptionally early spring with high temperatures and drought, resulted in the early appearance of the pea aphid (Illinoia pisi Kalt.). Aphids hatching from winter eggs are very few and none of these are winged. Nevertheless, thousands of winged aphids are found daily in alfalfa, and it seems certain that the majority of them have flown up from farther south on the steady, gentle, southerly winds. Canning peas only 2 or 3 inches high in several fields near Madison are generally infested with winged aphids which are already reproducing. If cool weather or copious rains, or both, do not soon occur, there is every prospect that the peas will be severely damaged, as they will not be able to outgrow the injury.

Usefulness of field roller or drag in pea weevil control.--That a flat-surfaced type of field roller or a drag may be used effectively as a supplementary control measure for the pea weevil (Bruchus pisorum L.) has been indicated in a recent report by F. G. Hinman, of the Corvallis, Oreg., laboratory. In a series of experimental tests with Austrian winter peas, wherein weevil-infested peas were placed on the soil surface and then pressed into the soil, it was determined that the resulting weevil mortality was approximately two and one half times that

occurring in shattered peas on the soil surface under otherwise similar conditions (36.5 percent versus 89.8 percent). In stored peas from the same field but kept under ordinary storage conditions only 5.5 percent of the weevils died. The tests were begun on August 9, 1933, and final examinations of the peas were made from November 19 to December 17. It is probable that high temperatures and desiccation accounted for most of the weevil mortality in the peas involved in the tests. Daily maximum air temperatures ranging from 87° to 95° F. were recorded during the period from August 9 to 13, and a maximum soil temperature of 130° F. was recorded on August 10 and again on August 13. Judging from the results obtained in these tests, a high degree of pea weevil mortality could be induced by running a roller or a drag over an infested field to break open the pods and to press the peas into the soil. These measures would be especially applicable in fields where the vines are cut and hauled to a stationary thresher, leaving the ground nearly devoid of straw; as a supplementary control measure on burned fields, where certain spots escaped the fire; or on garden plots after the vines have been gathered and burned.

How the pea weevil ingests poison.--A. O. Larson, Corvallis, Oreg., reports that the principal food of the pea weevil is the pollen of the pea flower, and that it feeds very little on any other part of the plant. Poison applied to the peas when in blossom do not reach the pollen, yet such treatments kill the weevil. Observations thus far have indicated that the poisonous dusts are taken into the weevil's body very largely through its habit of cleaning its fore tarsi. Weevils placed in a petri dish with a very small quantity of dust soon gathered comparatively large quantities of dust on their feet. They frequently stopped and drew the fore tarsi, and sometimes the distal half of the fore tibiae, through their mouthparts. The middle legs are cleaned by scraping them against the fore and hind legs, and the hind legs are brushed against the middle legs. The middle tarsi may be scraped by the fore tarsi directly under the mouthparts and the fore tarsi drawn through the mouth several times. Observations with binoculars brought out quite clearly that the fore tarsi were used to clean the middle tarsi and that they carried the poison to the mouth. Only on one occasion was a weevil observed cleaning its antennae. It did this by scraping it with the fore tarsi. The weevils in petri dishes were not observed to pick up dust particles by touching their mouthparts to the dusted surfaces on which they were walking, but those observed on caged pea vines sometimes touched their mouths to the plant when they came to a leaf or a tendril or some obstruction that caused them to change their direction.

Spring migration of leaf hoppers to beets early in Modesto, Calif., area.--W. C. Cook, of the Modesto, Calif., laboratory, reports as follows: "The migration of the beet leaf hopper (Eutettix tenellus Bak.) from the foothills to the beets and summer host plants occurred several weeks earlier than in 1933, because of the more advanced season and the earlier drying of the foothill vegetation. The first movement was noticed in the Modesto area late in March, and the leaf hoppers reached the lower

Delta beets prior to April 6. On that date a population of 12 hoppers per 100 feet of row was found on Union Island. The same number were found in one field on Bishop Island on April 10, but populations were lower in other fields. On this date a few hoppers could be found even in the most northern areas. The collections indicate that another migration occurred about April 18, although populations in the beets were not materially increased. Between April 20 and 23, there was a movement from the southern section, resulting in a noticeable increase in population near Modesto. At the present time there are no high leaf hopper populations in the beets north of Stockton."

Derris as stomach poison fails to kill larvae of variegated cut worm.--G. E. Washburn, of the Alhambra, Calif., laboratory, reports as follows: "Larvae of the variegated cutworm (Lycophotia margaritosa saucia Hbn.) in the last instar were used in a small series of tests to determine the effect of derris purely as a stomach poison. Kale leaves were dusted and made into sandwiches, so that there would be no contact between the dust and the bodies of the larvae. Thirty larvae were fed sandwiches of 10 percent ground derris dust (6 percent rotenone) in diatomaceous earth, with no ill effects whatever; 30 larvae were fed pure ground derris dust (6 percent rotenone) with no ill effects; 30 larvae of the fourth instar were fed derris dust (6 percent rotenone) with no ill effects; 20 larvae of the same age were put on leaves freshly dusted with pure derris dust and showed no ill effects. The only effect noted was that the derris seemed to be somewhat repellent, as the larvae did not eat as freely of the treated material as they did of the untreated."

Derris dust not toxic to celery leaf tier, tests indicate.--According to a report from the Sanford, Fla., laboratory, the results of a single test, presented in the table below, indicate very clearly that the use of rotenone products will be very limited, if not entirely impractical against Phyctaenia rubigalis Guen.

Percentage of rotenone in dust	Larvae killed in 6 days		
	One fourth grown	Half grown	Mature
	Percent	Percent	Percent
0.1-----	8.7	0	0
0.5-----	6.7	0	0
1.0-----	16.6	1.8	0
3.0-----	41.3	7.2	0

No noticeable effects resulted from the use of any of the dilutions against the larger larvae, and even the 3 percent dust gave unsatisfactory results against the small larvae. In all of the derris tests with the celery leaf tier it was noted that the repellent effect of the dust was much less than with the southern armyworm (Prodenia eridania Cram.) and several species of cabbage worms. The amount of feeding of the armyworm and cabbage worms decreased as the dust concentration was increased, but there was some feeding in all cages.

Derris and cube dusts prove effective against tobacco flea beetle.--
F. S. Chamberlin, of the Quincy, Fla., laboratory, reports as follows: "Preliminary tests performed last season indicate that derris and cube dust offer much promise as control agents against Epitrix parvula Fab. on shade-grown tobacco. A series of experiments with these poisons was carried out on plant beds during March and April. Tobacco dust and kaolin were used as diluents. Both derris and cube dusts containing 1 percent rotenone gave good control in light infestations. No heavy infestations were available for treatment. Neither poison caused injury to the foliage, even when applied in the undiluted form. Plant beds in this region are very susceptible to poison injury and all materials tested in the past have caused some damage when applied under certain conditions."

Study of celery growth gives index regarding safe interval between cessation of arsenical application and harvest.--As a means of determining the proper time interval between the cessation of applications of poisonous insecticides to celery and the time of harvesting in order to avoid harmful residues on the market product, C. F. Stahl, of the Sanford, Fla., laboratory, tagged new leaves of celery plants at weekly intervals in celery plantings made during October, November, and December 1933. The last of these tagged plants were harvested on April 9, 1934. The age of the oldest leaf remaining upon individual celery plants when the celery was sent to market ranged from 35 to 49 days in the three principal plantings, and in the two principal celery-growing districts of the Sanford section. Although the average age of the oldest leaves remaining on the market product ranged from 33 to 39 days, it is apparent that, in order to insure a proper margin of safety in the quantity of insecticidal residues on the market product, arsenicals should not be applied to celery plants within a period of 7 weeks prior to harvest, under conditions existing in the winter growing of celery in the South.

Similar studies are being conducted with other crops, such as cabbage, lettuce, and spinach, but data on these crops are not yet available.

Spotted cucumber beetle larvae found feeding on cabbage leaves.--C. E. Smith, of the Baton Rouge, La., laboratory, reports that while making routine examinations of cabbage plants on his experimental plots many nearly full-grown larvae of Diabrotica duodecimpunctata Fab. were observed feeding on leaves of cabbage that had been covered with soil during cultivation. Many of these larvae were of a decided greenish color, attributable to their feeding on the green leaves of the cabbage. This rather unusual observation seems worthy of note, as larvae discovered feeding under such circumstances might easily be mistaken for other species.

Addition of molasses in cutworm baits may improve physical qualities.--H. H. Richardson, of the greenhouse insect laboratory, Washington, D.C., in his recent studies on the use of a mixture of molasses, water, and paris green for the control of thrips has found that the addition of molasses frees a greater quantity of arsenic in the mixture than is the case

when water alone is used, and that the paris green is deflocculated or broken down by the molasses. Since this is the case, the addition of molasses in a poisoned bait for cutworms might be an advantage, as particles of paris green would be smaller and a better distribution over the particles of bran could be obtained if the molasses and paris green were mixed together before adding the bran.--W. H. W.

Ground wheat superior to apples as wireworm bait.--According to F. H. Shirck, of the Parma, Idaho, sublaboratory, "There is a common report that apples make superlatively good bait for wireworms and in some of the work done recently a comparison was made between apples and bait made from graham-flour dough by planting the two alternately in a garden infested with wireworms. The species of wireworm involved was Pheletes canus Lec. At the end of 6 days, when the baits were taken up, 20 apples contained a total of 131 wireworms, or 6.5 per bait, while 20 graham-flour baits interplanted in the same row with the apples contained 267 wireworms, or 13.3 per bait. Many wireworms were found in the soil immediately surrounding some of the apple baits, suggesting that they had fed for a time and were leaving. However, the worms found in close proximity to the apple bait were counted together with those actually in the apples. Baits of ground wheat possess an advantage in that they remain in a state palatable to wireworms longer than do apples."

Why some arsenicals fail to kill wireworms.--C. E. Woodworth, of the Walla Walla, Wash., laboratory, believes that an answer has been obtained to the above question. A pair of chitinous plates in the mouth of the wireworm normally keeps the mouth closed unless it is opened by muscular tension. There are three pairs of active "feelers" (antennae and maxillary and labial palpi) that apparently recognize arsenic as an undesirable substance. As the result of a long series of feeding experiments, followed by arsenical determination tests, only one wireworm contained as much as 0.001 mg of arsenic in the digestive tract. These observations and experiments indicate that some arsenicals fail to kill wireworms because they do not take substances containing arsenic into the digestive tract. In wireworms the entire digestive tract, which must be tested, often weighs only about 1 mg. Consequently, were the ordinary Gutzeit apparatus used, the traces of arsenic in the sample would be lost before reaching the test paper. The apparatus used in the wireworm studies was therefore very much reduced in scale. A one half-dram vial was used as a generator. A tube 3 inches long and 12 millimeters in diameter was used as a scrubber and a 4-millimeter tube was used to hold the test paper. With this small-scale apparatus, quantities as low as 0.001 mg of arsenic can readily be detected. Another requirement for these studies was a cage in which the wireworms would feel at home and at the same time be away from soil and where they could be easily observed. As a result of experimentation, a satisfactory cage was developed, consisting of two microscope slides held 1/16 inch apart by means of wooden strips 3 inches by 5/16 inch by 1/4 inch, with two parallel grooves 1/8 inch deep. The space between the cover glasses was filled with cellu-cotton pads, dampened so that the atmosphere with 100 percent humidity was maintained. The

ends were closed by small, thin pieces of wood, and the cage was held together by a strong rubber band. Food, consisting of corn-starch pellets, was found to be very satisfactory.

Manuscripts

Flooding soil to control wireworms.--M. C. Lane, of the Walla Walla, Wash., laboratory, was at the Washington, D.C., office from April 23 to May 1, and reviewed the manuscript entitled, Flooding Soil to Control Wireworms, by M. C. Lane and E. W. Jones, the investigations upon this project having been conducted under the direction of Mr. Lane. In this manuscript the authors have presented the results of 3 years' investigations on the possibility of controlling wireworms by flooding infested soil. The species concerned were principally the sugar beet wireworm (Pheletes californicus Mann.) and the Pacific Coast wireworm (Pheletes canus Lec.). Field tests on a large-scale substantiated the results obtained from laboratory and cage experiments in demonstrating the practicability of flooding as a control measure under the conditions encountered in certain of the irrigated districts in the State of Washington. From 95 to 100 percent of the wireworms involved were killed in 1 week as a result of flooding the soil while the mean soil temperature was 75° F. or above. Flooding as a control measure against wireworms apparently possesses possibilities when and where there are soil temperatures of 75° F. or above for a period of a few days. This manuscript will be presented for approval by the Bureau. Very few references relating to submergence in water as a control measure against wireworms have been found in the literature.

A study of wireworm populations.--Mr. Lane and E. W. Jones, Walla Walla, have submitted a manuscript entitled, A Study of Wireworm Populations, presenting results of a rather difficult study which had for its objective the determination of the size of the unit area and the number of units necessary to constitute an adequate sample. These two problems are discussed with special application to their utility in measuring the results of control operations in the field, as well as for advising other workers as to the methods used in connection with wireworm problems.--D. J. C.

CEREAL AND FORAGE INSECTS.

Grasshopper control campaign.--A report from B. M. Gaddis indicates that the extensive grasshopper control campaign being carried on under the direction of J. R. Parker in the Northern Great Plains States, by the Bureau, in cooperation with the States, is well under way. A mill-mixed bait consisting of bran, sawdust, molasses, and white arsenic is being used in the heavily infested area. The bait is being produced at the rate of nearly 100 carloads a day and is being shipped to local distributing points in Wisconsin, Minnesota, North Dakota, South Dakota, Nebraska, Montana, Wyoming, and Idaho, in accordance with estimated needs, based on a fall survey conducted cooperatively by Bureau and State Entomologists. Hatching was becoming general by the end of the month, although

general spreading of the bait had not yet begun. In addition to the above-mentioned States, bait materials are being shipped to other sections having heavy grasshopper infestations, outside the main area. Bait has been allotted to Nevada, Arizona, Oregon, Kansas, Utah, Colorado, and Michigan, in addition to the States covered by the fall survey. Active distribution of the bait has been under way in the more southern sections. Approximately 25 percent of the estimated total bait is now delivered to the local distributing points.

Large numbers of chinch bugs left winter quarters in April.--W. T. Emery, Wichita, Kans., reports that an examination of 13 samples, each 1 foot square, of Andropogon sod since April 11, revealed an average of only 21 bugs per square foot, as compared with an average of 195 bugs per square foot in samples taken in the winter. Oviposition began in wheat about April 20. Curtis Benton, of the Lafayette, Ind., laboratory, has been temporarily stationed at Aurora, Ill., where he is cooperating with Professor J. P. Flint in studying the food preferences of the chinch bug during the present severe outbreak in that area. A series of observation fields have been located for the purpose of determining whether barley can be used as a trap crop to prevent injury to other types of small grains.

Pea aphid on vetch and Austrian winter field peas in Willamette Valley.-- L. P. Rockwood and T. R. Chamberlin, Forest Grove, Oreg., report that rains, intermittent throughout April, have kept the fungous disease caused by Empusa aphidis active during most of the month. This disease has reduced the aphids (Illinoia pisi Kalt.) to numbers that are now causing little or no injury, both in vetch and pea fields, although some pea fields still contain many aphids. The fungus continues to be effective during warm clear days following rains, provided abundant dew remains upon the plants for some hours of the day.

The remarkable effect of this fungus upon population is shown in a 50-acre field of vetch which was being plowed on April 5 and which has been apparently ruined, aphids at that time averaging several thousand per 100 strokes of the net. As plowing of this field was not completed, we had an opportunity on April 27 to examine the remainder of the crop. By this time the fungous disease had reduced the numbers of aphids to less than 100 per 100 strokes of the net and undamaged plants were numerous. Provided the aphids do not again increase to destructive numbers, a fair crop of vetch should be produced. Some of the plants badly damaged on April 5 had been killed, but others had partially recovered by putting out new terminal shoots or new shoots farther down on the stems.

On April 16 Austrian field peas infested by I. pisi were dusted with derris dust with a silica filler, rotenone content 0.5 and 0.7 percent, and by nicotine with a lime filler, 4 percent nicotine or 10 percent nicotine sulphate equivalent. The maximum reduction of aphids in the best parts of these plots was not over 50 percent and nothing approaching practical control was obtained.

Syrphid flies and their eggs were common during the month on both peas and vetch, and many larvae were taken from these plants, and also from grain. According to field observations and rearings in the laboratory, the commonest species in the order of their abundance were Syrphus torvus Osten Sacken, and Syrphus opinator Osten Sacken and Lasiophicus pyrastris Linne. These appear numerous enough to effect a considerable check upon the aphids. Coccinellid larvae were first taken in any numbers on April 17 when they were numerous in wheat with volunteer vetch in the Molalla, Oreg., district. Most of these apparently belong to the genus Coccinella.

Aphids on grain in Oregon.--Macrosiphum granarium Kby. and Rhopalosiphum prunifoliae (Fitch), which were abundant during March, were also reduced in numbers in April by the fungous disease, Empusa aphidis. Much yellowing of wheat leaves, first noticed by farmers when the aphids were abundant, was thought by many to have been caused by these insects. Most of this yellowing and dying of the leaves is increasing in the absence of aphids and is caused by the rust Puccinia triticina Eriks., which is very prevalent this spring.

The wheat joint worm in Oregon.--T. R. Chamberlin, Forest Grove, Oreg., reports that the first adults of Harmolita tritici Fitch issued in the Molalla district on April 6. This is 11 days earlier than the earliest previous record, April 17, 1930. Adults were very scarce on the first day of issuance and very few had issued by April 20. The first adults of the parasite Eurytoma parva (Girault) Phillips issued on April 17. Continuously wet herbage during the last 8 days of the month delayed systematic sweepings over the infested territory and scouting for the insect in new territory.

The hessian fly.--M. M. Reher, Forest Grove, reports that the early and mild spring with abundant wheat suitable for oviposition is responsible for a very heavy infestation by Phytophaga destructor Say in the Willamette Valley. Frequent complaints are heard from farmers who believe the hessian fly to be responsible for the yellowing and stunting of the plants which is caused by rust. It is probable that the hessian fly and rust combined will greatly reduce wheat yields, and some farmers are considering plowing up some of the worst injured fields and seeding to other crops.

April weather unfavorable to hessian fly.--J. R. Horton, Wichita, Kans., reports that, although there was no local deficiency of moisture in April, as several effective rains totaling from 3.36 to 4.22 inches, were well distributed on the different plots under observation, emergence was intermittent, and oviposition was scant and prolonged throughout the month. Hatching and migration also were retarded. As a result, the population of first-generation forms has remained comparatively low. The average infestation and the number of larvae and puparia per 100 culms for the month were as shown in the tabulation. While slight infestation was to be expected as a result of the fly reduction caused by premature

emergence last fall before planting time, retarded emergence and obstructed oviposition were apparently due to widely fluctuating temperatures.

Plot	Culms infested	Average larvae and puparia per 100 culms	
		Percent	Number
Irrigated-----:	4.6	:	6.6
Nonirrigated-----:	1.6	:	2.1
Riverside-----:	8.5	:	11.3
Upland-----:	9.4	:	15.2
:	:	:	:

Egg deposition by caged hessian flies.--E. T. Jones, Wichita, reports that in making tests of the effect of an essential plant-food element on fly resistance and of hybrid selections, involving 72 individually caged flats, the introduction of 841 pairs of flies (in 5-pair lots) was necessary before he obtained a satisfactory number of eggs. In similar tests involving 18 small field cages, 523 pairs of flies were required before a satisfactory deposition could be obtained.

FOREST INSECTS

Introduced parasites carried successfully through winter.--Two shipments of the tachinid parasite Compsilura concinnata Meig. were received by the Portland, Oreg., field laboratory from Melrose Highlands, Mass., last September. The first shipment contained 305 and the second 271 puparia, from which adults had started to emerge when the shipments were received. Through cooperation with the Oregon State Agriculture College, J. R. Roaf, Assistant in Entomology, undertook the work of rearing, mating, and parasitizing various caterpillars with the flies. Four chalcid hyperparasites were intercepted. About half the shipments were liberated last fall. Many of the others died during the winter, but about 24 adults were successfully carried through in cages and, now that caterpillar food is again available, they have mated and started laying eggs on a large series of tent caterpillars. It is hoped that an abundant progeny will be produced by fall.

Fir engraver beetle in northwestern Oregon.--Scolytus ventralis Lec. has recently been found to be numerous enough to cause dying white fir in at least three localities in northwestern Oregon. F. P. Keen found this insect killing white fir on Senator McNary's farm near Salem; J. A. Beal later found a similar case at Clackamas, near Portland, and more recently found this insect actively abundant near the coast at Grand Ronde, where previous attacks by it had so scarred white fir now being cut for pulpwood that the operators became alarmed and asked for an examination of their timber with recommendations for prevention of this damage. S. ventralis occurs from British Columbia to Arizona and New Mexico.

Barkbeetles make early attacks.--A mild winter and early spring have caused rapid development of barkbeetle broods in central Oregon pine forests. A recent examination by W. J. Buckhorn on the Ochoco National Forest showed that adults of Dendroctonus brevicomis Lec. had been emerging since early in April and the new broods had reached the stage of pupae and new adults on the south side of the trees and of larvae and pupae on the north side. Some adults emerged on April 18 and 20, 57 days earlier than the first emergence last year, which did not occur until June 15. New attacks on logs felled during the winter were found on April 13, 84 days earlier than the first attacks found last season. Such early development makes possible a tremendous increase in beetle population and destructiveness this year.

Are we due for another forest tent caterpillar outbreak?--Owing to the past mild winter, the western tent caterpillar (Malacosoma pluvialis Dyar) is unusually abundant on the willows and alders of the lower Columbia River Valley. In talking with W. J. Buckhorn, a local farmer recalled that in 1894 these tent caterpillars were so abundant that, like the locust hordes of Egypt, they devoured everything green in sight, including the foliage of fir trees. The outbreak this year looks as though that early disaster might easily be repeated.

Important cerambycid parasite determined.--In a recent examination of overwintering brood trees of the western pine beetle, Mr. Buckhorn found that the larvae of Acanthocinus spectabilis Lec., which are common under and in the bark, were underdeveloped and inactive. Many were putty-colored or light brown. Dissection of 46 larvae showed that 43 were parasitized by a large dipterous larva which had been reared from larvae and adults in the caging experiments of last year and identified by J. N. Aldrich as Arctiophyto gillettei Tns., related species of which are known to parasitize other longicorn beetles.

Recovery of parasites in Washington State.--P. B. Dowden, Melrose Highlands, reports that R. Latta and W. L. Baker, of the Sumner, Wash., laboratory, made several collections of satin moth material at the parasite liberation point at Kent, Wash., in April. These collections resulted in the recovery of two important European parasites, Apanteles solitarius Ratz. and Meteorus versicolor Wesm., which have been liberated there in the last few years, the material having been forwarded from the Melrose Highlands laboratory. Mr. Latta reported that Apanteles cocoons were fairly numerous. Meteorus cocoons were very plentiful at Kent, every tree having a hundred or more hanging from the underside of the limbs. At Thomas (2 to 3 miles from the point of liberation) the cocoons were scattered but not hard to find, and at Auburn (6 to 7 miles from the point of liberation) one cocoon was found after careful examination of four large trees. One hundred small satin moth larvae collected at Kent on April 3 were dissected at Melrose. Three of them were found to be parasitized by Apanteles and 37 by Meteorus. Apanteles solitarius Ratz. has been established in New England, where it is a very effective parasite, but notwithstanding large liberations, Meteorus has never been recovered. The recovery of such numbers of Meteorus in Washington is, therefore, particularly gratifying.

P. B. Dowden reports on what appears to be the recovery of another hymenopterous parasite of the satin moth. Rogas unicolor Wesm., received from Hungary, was first liberated by the Melrose Highlands field laboratory in 1932. A Rogas larva was dissected in April from a hibernating satin moth caterpillar taken in Portland, Maine, where unicolor was put out in 1933, and there is little doubt that the Rogas larva found in dissecting the satin moth caterpillars belonged to this species.

European pine shoot moth.--All information from the entire infested region of the northeastern States and eastern Canada indicates that there has been a heavy reduction in European pine shoot moth larvae by winter killing. In most of Connecticut the mortality is about 90 percent with slightly less along Long Island Sound. In southern New York a projected control operation was cancelled because of the heavy mortality, and a similar condition doubtless exists in western New York. Reports from Canada indicate a very heavy reduction. Through the activities of the CCC camps the work of direct control in Connecticut is being increased and there is hope that the insect may be exterminated in most parts of the State, except the very heavily infested area in the southwest corner.

R. T. Webber, Melrose Highlands, states that two colonies of a tachinid fly Lypha dubia Fall. were liberated in April. One colony of 500 adults was put out in an infestation of the European pine shoot moth (Rhyacionia buoliana Schiff.) at Jericho, L. I., N. Y., and another colony in an infestation at Easton, Conn. Little is known concerning the habits of this fly, which has been obtained from European pine shoot moth material collected in Austria during the past few years. The puparia have been forwarded to Melrose and placed in hibernation, the flies issuing early the next spring. A few flies have mated in confinement but efforts to obtain further information on the biology of the fly have not been successful. It is of interest that there already occurs in New England a tachinid fly which taxonomically appears identical with the European species. The American form has never been reared from the European pine shoot moth nor are its habits known.

J. V. Schaffner, Jr., Melrose Highlands, presents information regarding results obtained by P. A. Berry and himself regarding parasitization of full-grown larvae and pupae of the elm leaf beetle (Galerucella xanthomelaena Schr.) by a species of Tetrastichus, first noted by the laboratory in 1932. Collections of larvae and pupae were obtained during July and August 1933, from points in New Hampshire, Massachusetts, Connecticut, and New York, and each larva or pupa was placed in a gelatine capsule. Adults of the Tetrastichus issued during August and others issued in the spring of 1934. The records show that from 1 to 36 parasites issued per host. Records of particularly high parasitization were as follows: 48 percent of 100 pupae from Stratham, N. H.; 55.5 percent of 200 from Taunton, Mass.; and 58.5 percent of 200 from Southington, Conn.

Seasonal conditions in northern California from 30 to 60 days earlier than in 1933.--R. L. Furniss, of the Berkeley, Calif., field laboratory, states that during the first week of April 1934 a preliminary check-up of western pine beetle development in the Modoc Forest showed that in 1934 first pupae were formed about 30 days earlier than in 1933; height of pupal development was 50 days earlier; first new adults were observed 55 days earlier; and first emergence was 60 days earlier. If there is no prolonged cold, rainy weather during the late spring the period of brood development during the 1934 season should be very considerably lengthened over the normal for the region.

During the second week of February 1934, Enoclerus sphegeus Fab., Othnius umbrosus Lec. and the other subcortical associates of the western pine beetle were observed in flight on the Modoc. This was at the same time of year that severe winter kill of western pine beetle broods occurred in 1933.

Box elder bug a serious pest in Zion National Park.--Donald DeLeon, of the Berkeley, Calif., field laboratory, has just returned from the Zion National Park where a field study was made of the local infestation problems. Leptocoris trivittatus Say is a serious pest in this

park, owing to its abundance during the camp season. Adults and eggs of this insect were found in the valley floor of Zion Canyon in great numbers during the latter part of March. Another insect causing concern in the camp ground areas of this park is an undetermined species of tent caterpillar which defoliates the cottonwood. This insect was also appearing in numbers late in March on cottonwoods along the Virgin River, below Zion Park. It was apparently too early, however, for the seasonal appearance of the insect in the upper Zion Canyon.

Flatheaded borers kill Douglas fir in Yosemite.--During the last 3 years many Douglas fir trees growing in the Merced River Canyon and Yosemite Valley floor have been killed by the work of buprestid beetles, mainly Melanophila drumondi Kby. About 200 trees, infested by the larvae, were cut and burned in the park during the past winter through the use of CWA labor. The seasonal history of Melanophila in this locality has not been fully determined, but it is obvious that the larval period lasts two, and perhaps three, seasons. In order to obtain information on the seasonal development of the insect, Mr. DeLeon recently made a trip to the park and installed special rearing cages on infested trees.

Insect survey on Sequoia National Park.--A forest insect survey is now being conducted on the Sequoia National Park. Because of the very rough topography of the watersheds of this park, systematic cruises by section line are extremely difficult and are possible only in a few small areas. A system of spotting infested trees from vantage points is being employed, and an effort will be made definitely to fix the vantage points for certain areas for future work. By using field glasses in connection with a plane table map, it is possible to map the position of infested trees with considerable accuracy.

Maintenance control in General Grant National Park.--Maintenance control work on the General Grant National Park was completed in March. Previous control work in this national park has resulted in reducing the infestation of the mountain pine beetle in sugar pine to a very low point. It was found that the overwintering infestation in the park consisted of less than 20 infested trees and these were cleaned up by a small crew working for about 2 weeks.

White-pine weevil.--H. J. MacAloney of the New Haven, Conn., field laboratory, reports: "The spring activities of Pissodes strobi Peck have started in the New England States. On April 18 two white-pine weevils were collected at Petersham, Mass., feeding in bud clusters. Considerable search was made before these adults were taken. There were very few punctures in the two leaders and no eggs were found. No punctures were seen in any other leaders examined. On April 26 in a heavily infested plantation near New Haven eggs in quantity were found in many leaders and a considerable number of adults were found on many leaders. It appears that the heavy covering of snow during the period of subzero weather protected the hibernating weevils and, while there may not be an increase in the infestation this season, there very

probably will not be as pronounced a decrease as was noted last year. The decrease of last year should tend to keep the general infestation below normal, and it is my opinion that wherever it is possible, infested tips should be removed before July 15. This will reduce the number of weevils of the new generation as well as cause an improvement in the final stand."

Infestation of secondary barkbeetles in Yellowstone National Park.--T. T. Terrell, of the Coeur d'Alene, Idaho, field laboratory, reports the killing of several hundred small lodgepole pine trees along the highway between Obsidian Cliffs and Madison Junction, in Yellowstone National Park. The dead trees, which were evidently weakened by the action of adjacent hot springs, occur in rather large groups and were apparently killed by an overabundance of secondary barkbeetles, Pityogenes kuecheli Sw. The problem is further complicated by the presence of a species of Pissodes and of red turpentine beetles (Dendroctonus valens Lec.) in the roots and root collars. As a means of roadside cleanup, the trees were cut and burned in April so as to destroy the insect broods before the first emergence in the hope that the devastation will be checked.

Stone flies.--J. C. Evenden reports an epidemic of stone flies (Plecoptera) defoliating cottonwood, elms, and cherries at Coeur d'Alene. This is the first record of these insects appearing in the northern Rocky Mountain region in such numbers as to become a potentially serious enemy of shade trees.

Lead cable borer empties wine barrels.--On April 26 Perez Simmons and C. K. Fisher, of the dried-fruit insect laboratory at Fresno, Calif., were requested to give advice in connection with damage being done to wine barrels in a Fresno winery by Scobicia declivis Lec. Beetles were boring in oak wine barrels, especially those stored near the windows. The favored point of attack was where the beveled edge of the barrel head meets the groove in the staves, but attack was also observed around the bung and at other points. The beetles have since been reported boring in redwood wine casks that held as much as 60,000 gallons. The winery in question has lost two 50-gallon barrels of wine, each from the boring of a single insect. Here the damage done by an individual beetle amounted to \$55 (50 gallons at \$1.10 per gallon, including the Federal tax which was paid before the wine was lost).

COTTON INSECTS

Cotton flea hopper control in field plats in 1933.--K. P. Ewing and R. L. McGarr, Port Lavaca, Tex., have completed their report on last season's field plat control experiments. Sweepings of cotton throughout the season to determine the abundance of the species of mirids that were present and causing the "hopper" damage showed that Psallus seriatus Reut. was, for all practical purposes, the only species causing damage in the experimental plats. The cotton plant bug (Adelphocoris rapidus Say) was present in small numbers but no tarnished plant bugs (Lygus pratensis L.) were taken. This is in contrast to conditions in the Delta of Louisiana and Mississippi, where the tarnished plant bug often causes considerable damage. The cotton in most of the cuts matured before boll weevils became numerous enough to do any damage, although the infestations of bollworms and leafworms interfered to some extent in some plats. Complete records of plant heights, form counts, boll counts, and growth conditions were made throughout the season. Comparable cuts, of 2 and 3 plats each, with a check for each cut were used. The insecticides tested in the field were two brands of sulphur on 11 plats, sodium fluosilicate on 4 plats, and a mixture of 75 percent calcium arsenate and 25 percent paris green on 6 plats. The details of applications and yields are given in the following table:

		Yield of seed cotton per acre			Increase in yield over check						
Cut	Effective applications	Sodium: Sulphur: fluosil: Mixture			Sulphur		Sodium		fluosili- cate		
		Check	Sulphur	fluosil	Mixture	Lbs.	%	Lbs.	%	Lbs.	%
	Number	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	%	Lbs.	%	Lbs.	%
A....	4	724	874	--	--	150.0	20.7	--	--	--	--
B....	5	592	944	--	--	352.0	59.5	--	--	--	--
C....	4	498	822	--	--	324.0	65.1	--	--	--	--
D....	5	693	860	--	--	167.0	24.1	--	--	--	--
E....	4	618	856	772	--	238.0	38.5	154	24.9	--	--
F....	2	1050	1194	--	--	144.0	13.7	--	--	--	--
G....	4	606	974	802	--	368.0	60.7	196	32.3	--	--
H....	4	1252	1384	1206	--	132.0	10.5	-46	-3.8	--	--
I....	4	422	--	522	546	--	--	100	23.7	124.0	29.4
J....	4	923	1334	--	1112	411.0	44.5	--	--	189.0	20.5
K....	3	410	570	--	516	160.0	39.0	--	--	106.0	25.9
L....	4	172	260	--	324	88.0	51.2	--	--	152.0	88.4
M....	6	766	--	--	1070	--	--	--	--	304.0	39.7
N....	6	964	--	--	960	--	--	--	--	-4.0	-0.4
Average per acre		--	--	--	--	230.4	33.6	101	13.9	145.2	23.8

The various sulphur plat experiments were started from May 16 to June 24, the infestation in the different plats ranged from light to heavy, and the number of effective applications ranged from two to five per plat; consequently, the results of these experiments are probably in line with what should be expected under average dusting conditions in the field. The final yield of cotton from the different plats showed that the sulphur was more effective in controlling the cotton flea hopper than was the mixture or the sodium fluosilicate, and that the mixture was more effective than the sodium fluosilicate. The 11 plats dusted with sulphur averaged 230.4 pounds of seed cotton per acre, or 33.6 percent, more than the 11 corresponding check plats, the increase in yield ranging from 88 to 411 pounds. The 6 plats dusted with the mixture produced an average of 145.2 pounds, or 23.8 percent, more cotton than the 6 corresponding check plats, the range being from 44 to 304 pounds. The 4 sodium-fluosilicate plats yielded an average of 101 pounds, or 13.9 percent, more than the 4 check plats, the range being from 46 to 196 pounds. The average cost of treatment of the 11 plats dusted with sulphur was \$2.54 per acre, or approximately 50 cents per acre-application, counting the cost of applying the dust (labor, machinery, etc.) at 25 cents per acre-application and the cost of the sulphur at 2 1/4 cents per pound.

Ordinarily the seed will sell for enough to take care of the picking and ginning of the cotton. Figuring the value of the lint cotton at 12 cents per pound, the 230.4 pounds of seed cotton, or 76.8 pounds of lint cotton, would be worth \$9.22. Deducting the cost of dusting, \$2.54 per acre, the average net gain from the increased yield as a result of the sulphur dusting was \$6.68 per acre. The mixture cost 9 cents per pound. The cost of applying the dust is figured at 25 cents per acre-application, the same as above. A total of 244.75 pounds of the mixture was used on the 6 plats, making the cost of the insecticide \$3.67 per acre. The average cost of applying the dust was \$1.42 per acre, making the total cost of dusting the mixture, \$5.09 per acre, or 90 cents per acre-application. The average increase in seed cotton per acre in the mixture-dusted plats over the checks was 145.2 pounds, or 48.4 pounds of lint cotton. The value of this lint cotton at 12 cents per pound would be \$5.81. Subtracting \$5.09, the cost of dusting, the average net gain from the increased yield as a result of dusting with the mixture was 72 cents per acre. The average cost of treatment of the 4 plats dusted with sodium fluosilicate was \$6.35 per acre, figuring the sodium fluosilicate at 8 cents per pound and the cost of applying the dust at 25 cents per acre-application. The sodium-fluosilicate plats yielded an average of 101 pounds of seed cotton per acre more than the check plats. Figuring the value of this cotton on the same basis as for the above plats, the gross gain of the dusted plats over the checks would be \$4.04 per acre. Subtracting the value of the increased yield of cotton, \$4.04, from the cost of the dusting, \$6.35, gives a net loss of \$2.31 per acre as a result of dusting with sodium fluosilicate.

More on the cotton flea hopper.--Reports from T. C. Barber, Brownsville, Tex., indicate that the cotton flea hopper is beginning to recover from the effects of the hurricane in September 1933. Two specimens were collected on horsemint on April 19 and several more have been taken in sweepings since that time but they are still surprisingly scarce, considering the unusually large quantities of blooming horsemint. None had been found on cotton up to May 1, although the plants were a foot tall and were producing squares.

K. P. Ewing, Port Lavaca, reports that owing to the cold, wet spring, the cotton crop is later than last year, with considerable acreage not planted by May 1. Hatching of flea hoppers from overwintering eggs in hibernation cages is also later, amounting to 59 percent of the number hatched last year by the end of April. The first adult was found on primrose in the field on April 9, the same date that the first one matured in the insectary. From this date on the population rapidly increased and migration, as shown by catches on tanglefoot screens, started on April 17, although the first adults and nymphs were not taken on cotton until April 24. At Port Lavaca emergence records from 10 hibernation cages containing Croton capitatus plants collected at weekly intervals beginning September 1, 1933, show the least emergence to be 156 nymphs from 100 plants collected September 1, and the highest, 4,264 nymphs from plants collected on October 27. The five collections made in September averaged 964.4 flea hopper nymphs per 100 plants, whereas the five collections made from October 6 to November 3 averaged 3,352.2 nymphs per 100 plants. From all the cages (3,700 plants) 22,837 nymphs emerged in April. The peak of the emergence was during the week of April 15 to 21, when 13,466 nymphs emerged. The peak last year was reached approximately three weeks earlier. The highest emergence for any day this season was 4,280 nymphs on April 18. The lowest daily emergence for the month was 19 on April 14, following the coolest day of the month, when the maximum temperature was 70° F., and the minimum was 50° F. The mean temperature, 60° F. on April 13, was 5° lower than on any other day during the month.

Croton clean-up in Calhoun County, Texas.--Although it is too early to draw conclusions as to the value or results of the CWA campaign in Calhoun County during the past winter, a comparison of the number of flea hoppers collected on the flight screens during April 1933 and April 1934 gives an indication as to its effectiveness. This year 12 screens collected 79 flea hoppers, or 6.58 per screen, during April, whereas last year 6 comparable screens collected 615 flea hoppers, or 102.5 per screen. The screen collections indicate that there were 15.57 times more flea hoppers in the fields of Calhoun County in April 1933 than in April 1934. The effectiveness of the clean-up campaign is also indicated by a comparison of the flea hopper infestation records made in cotton fields during April in Calhoun County and the adjoining county of Victoria, where the croton plants were not destroyed. Only 8 flea hoppers were found on 3,000 cotton plants in 15 fields in Calhoun County, while in Victoria County 55 flea hoppers were found on

2,000 plants in 9 fields. In Calhoun County there were 0.26 flea hoppers per 100 plants, while in Victoria County there were 2.75 hoppers per 100 plants, or 10.57 times as many hoppers as in Calhoun County.

Tarnished plant bug scarce on Texas coast.--Although the cotton flea hopper (Psallus seriatus Reut. and the tarnished plant bug (Lygus pratensis L.) are in some regions frequently numerous in the same fields, this is not the case in the vicinity of Port Lavaca, Tex., where the flea hopper is a serious pest nearly every year. K. P. Ewing reports that during April no specimen of L. pratensis was taken at Port Lavaca, although butterweed was in full bloom and sweepings were made from April 4 to 19. He says, "This is the same plant that is found abundantly in the Louisiana Delta, near Tallulah, and from which thousands of L. pratensis are collected per 100 sweeps the latter part of April."

Bollworm experiments in 1933.--E. W. Dunnam and R. W. Moreland, of Bryan, Tex., have submitted their report on the cotton bollworm experiments conducted last year in the Brazos River bottoms in Texas. The bollworm (Heliothis obsoleta Fab.) often causes severe damage in this section and is usually more important as a cotton pest than is either the boll weevil or the flea hopper. The infestation in 1933 was light, the maximum percentage of damaged forms in the check plats being 17.5 percent and the maximum infestation by the weevil, with one exception, never exceeding 5 percent. Even under these conditions, sufficient control was obtained by dusting with calcium arsenate to show a profit on all of the plats treated. Six plats receiving 5 applications of calcium arsenate at 5-day intervals, starting with bollworm egg deposition, made an average gain per acre of 250 pounds of seed cotton and a profit of \$5.60. Two plats receiving 3 applications of calcium arsenate, timed from the beginning of egg deposition, increased the yield 118 pounds of seed cotton per acre and gave a profit of \$2.82 per acre. One plat, receiving 3 applications of calcium arsenate delayed 10 days after egg deposition, had begun made a gain of only 77 pounds and a profit of \$0.64. Plats dusted with gas sulphur and 300-mesh sulphur showed decreases in yield. These tests confirm those of previous years and show that bollworm control by calcium arsenate dusting is practicable and profitable if done at the right time. To determine whether poisoning is necessary and the proper time for application is difficult. Egg deposition on cotton usually begins when about 90 percent of the corn silks in the locality are dry, and is usually much heavier on succulent cotton that is growing rapidly. A heavy egg deposition, however, does not necessarily result in a damaging infestation, as the hatching of the eggs and establishment of larvae on cotton fruit depend largely upon climatic conditions at the time.

Observations on the bollworm and boll weevil damage in early and in late-planted cotton emphasized the value of early planting when possible. Although there was little bollworm damage in either the

early or late plats, the cotton planted early escaped serious weevil damage, whereas the crop of bolls on late-planted cotton was entirely destroyed, resulting in a 50 percent loss in production. Many farmers are aware of the importance of early planting but this is often impossible in the Brazos River bottoms, owing to overflows and the difficulty of obtaining a good stand. Last season a good stand of late-planted cotton with insect control gave increased profits over cotton planted early. Observations of the insect damage on fertilized and check plats conducted by the Agricultural Engineering Department of Texas A. & M. College gave no evidence of any difference. There were no increased yields of cotton from balanced fertilizers applied by various methods and in various quantities to these fertile bottom lands.

Movement of cotton insects in relation to wind direction.--The following notes on the relation of wind direction to the movement of certain cotton insects are submitted by G. L. Smith, J. C. Clark, and A. L. Scales, of the Tallulah, La., laboratory: "For several years flight-screen traps have been used at the Tallulah laboratory and at other points in Madison Parish, La., to study the movement of cotton insects in the cotton fields and between the cotton fields and wooded areas. These screen traps have all been of the rigid, stationary type, with 4 surfaces exposed to the north, south, east, and west. Considering cumulative data obtained over a period of several years in these studies with stationary screen traps, it is apparent that with most of the species of insects studied, the larger number were caught on the leeward sides of the traps (in relation to the prevailing wind direction). From the quadruple register in the laboratory's meteorological equipment the number of hours for each wind direction and each velocity was available daily, monthly, and yearly; but the changes in wind direction occurred so often, even during the same day, that it was impossible to read the screen traps for each of these changes in wind direction, which would have been necessary to obtain an accurate record of the number of insects caught during each period that the wind was from a given direction. In order to obtain an accurate record of the insect's movement with or against the wind, a revolving screen trap was designed which, with a windvane attached, would keep one surface exposed to windward at all times and the opposite surface exposed to leeward. Three of these revolving screen traps were constructed and set up on the laboratory experimental grounds and operated from June 1, 1932, to June 30, 1933, inclusive. Readings were made daily and recordings made of several of the cotton insects as they were taken from the windward and leeward sides of the traps. A total of 12,404 cotton insects were collected on the three revolving screen traps during the 13 months, and of this number 3,166 were taken on the windward sides of the traps and 9,238 on the leeward sides. Among the species taken were 130 boll weevils (Anthonomus grandis Boh.) taken on the windward side and 152 on the leeward side; Monocrepidius vespertinus Fab., of which 273 were taken on the windward side and 1,251 on the leeward side; of Graphocephala versuta (Say) 331 on the windward side and 672 on the leeward side; cotton flea hopper, 23 on the

windward side and 39 on the leeward side; of the glassy-winged sharp-shooter (Homalodisca triquetra Fab.), 2,031 on the windward side and 5,965 on the leeward side; and of Oncometopia undata Fab., 193 on the windward side and 849 on the leeward side. Of the 14 species of insects being studied only one, Stictocephala festina Say, was taken in larger numbers on the windward side than on the leeward side, 54 on the windward and 33 on the leeward side of the screens."

INSECTS AFFECTING MAN AND ANIMALS

Under the auspices of local civic bodies a mass meeting was held in Savannah, Ga., on April 10, at which a discussion of mosquito and sand fly problems took place. About 800 interested citizens of Savannah and Chatham County attended the meeting, which was addressed by the Hon. Thomas Gable, Mayor of Savannah, Dr. Victor H. Bassett, Health Officer of Savannah and the County of Chatham, W. E. Dove, and F. C. Bishopp. The Department motion picture on mosquitoes was shown. The interest in continuing the mosquito and sand fly control operations, which have been going on for several months under the auspices of the CWA, was manifest, and efforts are being made to provide for their continuance.

Survey of surgical maggot production.--S. W. Simmons, of the Bureau's Washington, D. C., laboratory, made a field trip during the period April 11 to 14 for the purpose of investigating the commercial production of surgical maggots and maggot production as practiced in hospitals. The points visited were New York City, Pearl River, N.Y.; and Newark, N. J. At the present time only one commercial company (located at Pearl River) is engaged in selling maggots. Their business has declined considerably and for that reason the officials of the company were of the opinion that the use of maggot therapy was decreasing. A survey made by our own laboratory, however, reveals the fact that the maggot treatment is growing rapidly, having spread to every State in the Union and to several foreign countries. The decrease in the number of sales is, no doubt, due to the excessive price of \$6 per bottle (enough for one implantation only), which is charged. Many hospitals that formerly purchased their maggots are now producing their own at much less expense.

Tobacco oils effective against fleas and ticks on fowls.--In an earlier number of the Monthly Letter a report was made concerning preliminary tests of certain tobacco oils in control of the sticktight flea (Echidnophaga gallinacea Westw.) and the fowl tick (Argas miniatus Koch). During April field tests of these oils have been conducted. The results closely approximate those obtained in the laboratory, which were quite promising. While there has not been enough of some of the materials available to make extensive field tests, some practical tests have been made and it is indicated that the tobacco oils are quite useful in control of the sticktight flea and the fowl tick. The advantage of these

oils over creosote oils lies in the fact, as indicated, that they are not so toxic to fowls, and are apparently quite as toxic to fleas and ticks. No bad effects have been observed on fowls, even when quite heavy applications were made in close coops or chicken houses.

On April 24 F. C. Bishopp sailed from New York, en route for Panama. The trip was in response to a request from Col. J. F. Siler, Chief of the Health Department of the Canal Zone, and from directors of the Gorgas Memorial Laboratory for assistance on certain problems of medical entomology. Among these problems are the control of one of the principal malaria-carrying mosquitoes Anopheles albimanus Wied., which is breeding in Gatun Lake and invading distant towns; the recurrence of relapsing fever, which is borne by certain ticks in the Zone; and insect transmission of trypanosomiasis in livestock. Doctor Bishopp expected to sail on the return trip on May 20 and to reach New York on May 28.

BEE CULTURE

While making a survey of the beekeeping industry in California, E. L. Sechrist and F. E. Todd, of the Pacific Coast Bee Culture Field Laboratory, Davis, Calif., visited the Imperial Valley, from which for several years have come reports of poisoning of colonies of bees, and also of cattle, from arsenical dust applied by airplane to peas and other vegetable crops, enough of the dust having drifted to adjoining fields to cause poisoning of bees and cattle feeding there. In 1932, 2,300 colonies of bees were reported killed outright, with the field force of about half as many more colonies having been killed, with the result that no crop was produced. Seven out of 15 beekeepers visited by Sechrist and Todd in 1933 reported losses from such poisoning, the losses running from 30 percent of the crop to the entire loss of 200 colonies by one beekeeper. Other losses resulted from endeavors to move apiaries out of areas near which the arsenical dust was applied. Because of such losses, the beekeepers of the valley joined in bringing civil suit against one of the companies engaged in airplane dusting, in order to test the rights of beekeepers. The suit was won by the beekeepers, setting a precedent on the Pacific Coast in the collection of damages for bees killed by spray poisoning. The Judge of the Superior Court of Imperial County ruled that "if growers distributed poisonous compound by an airplane or in any other manner, and if the poison drifted on the lands of others and did damage to crops or stock, the persons spreading the poison are liable to damages." The testimony proved the losses of bees and cattle by this poisoning. The trial continued for 3 days and attracted much attention from fruit and vegetable growers, cattle men, and beekeepers.

Warren Whitcomb, Jr., in charge of the Southern States Bee Culture Field Laboratory, Baton Rouge, La., has just completed a survey of the apiaries of producers of package bees and queens in Louisiana, Mississippi, Alabama, and Georgia. He reports that the shippers of package bees in

these States are swamped with orders, many of them having turned down more orders than they normally fill. Because of cold weather, the season has been backward and queens in particular are in great demand. Doctor Whitcomb emphasizes the necessity for the buyers of package bees having a better appreciation of the conditions under which producers of package bees and queens have to work. The buyer should always give the shipper a certain number of days leeway in filling orders, in order that he may select the best time for making up packages. If a shipper is compelled to fill orders on a certain day and that day happens to be cloudy and rainy, the field bees will all be in the hive and the buyer will get more old bees than if the shipper had been permitted to wait until the weather cleared, when the hive would have contained a larger proportion of young bees.

The season at Somerset, Md., is from 6 to 8 weeks behind normal. Winter conditions continued practically into March, when queen-rearing operations ordinarily start. However, drones and pollen have been abundant, although perhaps the supply of early nectar has been somewhat below normal.

W. J. Nolan of the Somerset, Md., laboratory accompanied D. L. Van Dine and B. A. Porter, of the Division of Fruit Insects, to the University Experiment Farm at Kearneysville, W. Va., where cooperative work is in progress on the use of organic sprays for codling moth control. This is a PWA project. Later, Geo. E. Marvin, of the Somerset laboratory, made pollination counts in the experimental orchard in which bees were placed, using trees in other commercial orchards in the vicinity as checks.

Jas. I. Hambleton, Somerset, conferred with J. P. Parrott and Donald Collins, of the New York State Agricultural Experiment Station, Geneva, N. Y., relative to pollination work in the orchards equipped with light traps, another PWA project in which the Division of Fruit Insects is cooperating. It was planned to collect pollination data in the same manner as was used in the Kearneysville, W. Va., area.

Three samples of brood comb submitted by beekeepers in North Carolina to the Bee Culture Laboratory have been diagnosed as containing brood infected with parafoulbrood, a few cases of which have been noted in North Carolina in previous years. The 3 cases this year, however, all came from the same county, indicating that the disease may be rather serious. The matter has been reported to the State Entomologist.

IDENTIFICATION AND CLASSIFICATION OF INSECTS

A large series of specimens of the curculionid genus Antliarhinus has been taken recently from the seeds of a South African cycad, Encephalartos sp., and has been identified by L. L. Buchanan. The weevil is said to be an agent in the pollination of the flowers of several species of cycads. Systematically, Antliarhinus is interesting because

of several structural peculiarities, chief of which is the extraordinary sexual disparity in the length of the rostrum, this part being two and one half times longer than the entire body in some females, but scarcely as long as the head and prothorax in males. From 50 Encephalartos seeds more than 900 specimens of Antliarhinus were obtained, mostly A. zamiae Thunberg. A smaller species, probably A. signatus Gyll., was found in several seeds, one seed containing 60 individuals.

A new United States record for the moth Athyrma ganglio Hübner has recently been set up by Foster H. Benjamin as result of his identification of specimens collected in Royal Palm Park, Fla., by F. Morton Jones.

In a lot of mosquitoes received from G. F. Knowlton, of the Utah Agricultural Experiment Station, Logan, Utah, was a male Culex salinarius Coq. taken at Corinne, Utah, on March 26, 1934. Two females from the same place and of the same date and a female from Logan, Utah, taken on March 24 were apparently of the same species. This species has heretofore been known only as far west as the Mississippi Valley.

In a lot of punkies received from G. F. Knowlton were some 530 specimens of Leptoconops americanus Carter. This species was described from females collected by H. S. Barber and placed as a variety of L. kerteszi Kieffer, a North African species. The discovery of males in this lot shows this American form to be quite distinct and of specific rank. This species was found to be very annoying to man just south of Great Salt Lake.

F. D. DeGant, of Cleveland, Ohio; a collector of Ichneumonidae, spent May 3 to 5 in the Division of Insects, working with R. A. Cushman on the subfamily Cryptinae.

Among a lot of undetermined Braconidae reared from the chestnut bast-miner (Ectoedemia phloeophaga Busck) by the Division of Forest Insects some years ago, C. F. W. Muesebeck found four specimens, including both sexes, of an undescribed species of the microgasterine genus Dirrhope Foerster. This genus has heretofore been known only from the unique male type of D. rufa Foerst., a European species.

A. S. Pearse, of Duke University, was a visitor at the Division of Insects on April 16. He brought with him, for study and identification by H. E. Ewing, a large collection of insect-infesting mites. Professor Pearse is chairman of a committee of Section F of the American Association for the Advancement of Science, which is working out a classification for the higher groups of the entire animal kingdom.

H. E. Ewing has identified as Paratetryanychus citri (McGregor) citrus mite specimens collected on rose at Vicoso, Minas-Gerais, Brazil, by E. J. Hambleton.

Anthony Musgrave, author of Bibliography of Australian Entomology (Published by the Royal Zoological Society of New South Wales, 1932), was a visitor in Washington on April 21, spending some time with the taxonomists in the Division of Insects.

PHYSIOLOGY AND TOXICOLOGY OF INSECTS

F. L. Campbell and W. N. Sullivan, Takoma Park, Md., completed an extensive series of tests against house flies, using acetone extracts of rotenone-bearing plants. The volume of extract, or its equivalent in weight of plant materials, required to kill 50 percent of the flies was determined. This measure of effectiveness was fairly well correlated with the methoxyl content of the plant materials, as determined by H. A. Jones, of the Insecticide Division of the Bureau of Chemistry and Soils. This is a further indication that methoxyl content or total acetone extractives may be a better index of insecticidal value than is rotenone content.

J. W. Bulger, Takoma Park, and M. C. Swingle, Sanford, Fla., made preliminary tests of phenothiazine as a stomach poison against lepidopterous larvae. This substance appears promising as compared with lead arsenate. Phenothiazine was prepared by L. E. Smith, of the Insecticide Division, and was first tested by J. W. Bulger against culicine mosquito larvae, to which it was more toxic than was rotenone.

PLANT DISEASE ERADICATION AND CONTROL

Blister rust control (NIRA program).—The winter field activities on blister rust control under NIRA funds in the Northeastern and Lake States was confined chiefly to mapping of pine and control areas in preparation for this season's work in eradication of Ribes. The area mapped in the Northeastern States, including white pine and protection zones, during this period totals 288,963 acres and was performed with an expenditure of about 12,000 man-hours of labor. In the Lake States 171,334 acres of white pine were located and mapped in preparation for Ribes eradication. In addition to performing their regular educational and service activities, the permanent blister rust control personnel assigned to the NIRA program supervised the work of CWA laborers on State blister rust control projects in seven of the cooperating States and blister rust pre-eradication surveys undertaken by some of the ECW camps.

In the West a very important accomplishment under the NIRA program for the Inland Empire was the pre-eradication survey during the fall of 1933. Following completion of Ribes eradication activities on the various forest areas, about 90 men were employed from NIRA funds for an average period of approximately 1 month on this survey. Divided into 12 parties under the supervision of permanent personnel from the Office of Blister Rust Control and from the Forest Service, these men operated in northeastern Washington, northern Idaho, and northwestern Montana. About 1,200,000 acres were surveyed but had the weather been favorable, approximately 2,000,000 acres of forest land supporting the most valuable stands of white pine in the Inland

Empire not previously surveyed, would have been covered.

Plans have been carefully formulated for the largest blister rust control program ever undertaken in the West, and a very mild winter made it possible to start control work in the western white pine region of the Inland Empire about May 1. If present plans are not altered materially, about 150 NIRA camps will be operated in this region. In addition, there will be 5 camps in southern Oregon, and about 35 in California. The average number of men to be employed for each camp is 30. Thus work is in sight for approximately 5,700 men for the season. Technical leadership for this work is furnished by the Bureau of Entomology. The labor and camp overhead for the camps on the national forests will be carried by the Forest Service and for the camps on State and private lands by this Bureau.

Field work in black stem rust prevention actively under way.-- Field labor activities in black stem rust control, interrupted by December weather, were resumed about April 1. By the first week in May 215 locally employed laborers were working in groups of 8 to 10, each crew under the leadership of an experienced foreman. This seasonal field work is based on the preliminary inspection of territory since January 1 by some 20 men trained in the scientific and informational phases of the stem rust control program. These men have prepared estimates for each area, giving the extent of the territory needing inspection, the probable amount of chemicals required, and probable number of man-days of labor. Comprehensive maps of the territory to be given attention have also been prepared for use by the crew foremen after they have become established in the county in which they will conduct eradication work. The further expansion of field activity during May and June will be made as rapidly as weather will permit the transportation of chemicals and equipment and the effective use of locally employed laborers. The men will be selected from lists furnished by the National Reemployment Office.

An allotment of Public Works funds in August 1933, to supplement the regular appropriation for the work, led to the eradication of approximately 350,000 barberry bushes in 3 1/2 months--about three times as many as had been removed under the regular appropriation during the first 8 1/2 months of the year. It is believed that last season's experience with the employment and handling of labor crews will add to the effectiveness of this season's program. The speeding up of this project materially benefits the present farm program by reducing the rust hazard, one of the great factors of uncertainty in planned production of wheat, barley, oats, and rye. Moreover, the project is proving to be an excellent means of engaging unemployed men in healthful, outdoor activity of service to the community and nation. About 73 percent of the money has been applied to payrolls. Analysis of previous occupations of laborers employed with Public Works funds on this project, shows that 158 different occupations were represented by 686 men. Further study of the past

history of the entire 1,039 laborers employed last season would doubtless add to this list of occupations, some of which would, obviously, more nearly prepare the employee for field work of this sort than would others. It was found, however, that with the experienced leadership available, the general efficiency of the group at the work assigned was highly satisfactory.